General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

NASA TECHNICAL MEMORANDUM

NASA TM-75586

THE M-15 AIRCRAFT

(SAMOLOT M-15)

(NASA-TM-75586) THE M-15-AIRCRAFT (SAMOLOT M-15) (National Aeronautics and Space Administration) 11 p HC A02/MF A01 CSCL 01C

N79-12063

Unclas
G3/05 38012

Translation of "Samolot M-15," Institut Lotnictwa, Biuletyn Informacyjny, Vol. 9, Nov. - Dec. 1972, pp 5 - 6

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 NOVEMBER 1978

THE M-15 AIRCRAFT

(SAMOLOT M-15)

R. Leliecki

The An-2 aircraft designed by O.K. Antonov, which has /5* been used and produced until now was built in 1949 as a multi-purpose agricultural aircraft and it served as a basis for the development of the An-2R agricultural version (among other versions). Throughout its more than 20-year-old history, this aircraft has been continually modernized, first in the USSR and subsequently since 1960 also in Poland, which allowed it to fulfill in many countries the part of basic agricultural aircraft equipment.

During the period in which the An-2 was produced, WSK [expansion unknown] in Mielec elaborated many design changes which to a greater or lesser degree had a significant effect on the engineering and performance characteristics of the aircraft and its service life. For example in this period, the service life before repair of the A-2R aircraft increased from 900 hours to 2000 hours and of the chemical tank from 100-150 hours to 1500 hours.

However, modernization possibilities were not inexhaustible, and now the time has arrived when it is simply impossible to improve the performance of the aircraft without serious changes affecting its very design.

On the other hand, the considerable requirements imposed

---

*Numbers in the margin indicate pagination in the foreign text.

on agricultural aircraft in the current five-year plan and in future plans by the basic customer of Polish aircraft equipment, the Soviet Union, preclude their possible realization either by way of slightly increasing the efficiency of currently used equipment or by an improvement of the organization of the servicing system. These changes must be radical ones which will allow to considerably increase the area sprayed from the air and considerably reduce the spraying cost per 1 hectare without increasing the quantity of equipment and personnel required to service the above area. This can only be achieved by an entirely new aircraft specially designed for agricultural services, and by ensuring its possible use for other purposes in the national economy.

Hence the development of a new specialized agricultural support aircraft allowing utilization of highly efficient agricultural equipment became a necessity. In the beginning, design teams in the Polish Peoples Republic and in the USSR were studying this problem separately. Hence in various concepts, a solution of this problem is based either on propulsion with an ASZ-621R piston engine or on turboprop or turbojet propulsion. As a result of examining these concepts, the variant based on using the serially manufactured AI-25 turbojet engine with a 1500 kg thrust and, so far, a total service life of 9000 hours was acknowledged to be most suitable. At the same time, the decision was made that the development and construction of the new agricultrural aircraft will be undertaken by Poland with considerable technical aid from the USSR. An agreement on technical collaboration in the domain of the aircraft industry between the governments of the USSR and PPR serves as a basis for undertaking the construction of the new agricultural aircraft. This agreement was signed together with the protocol on direct collaboration of both industries in Warsaw on 2 December 1971 by the

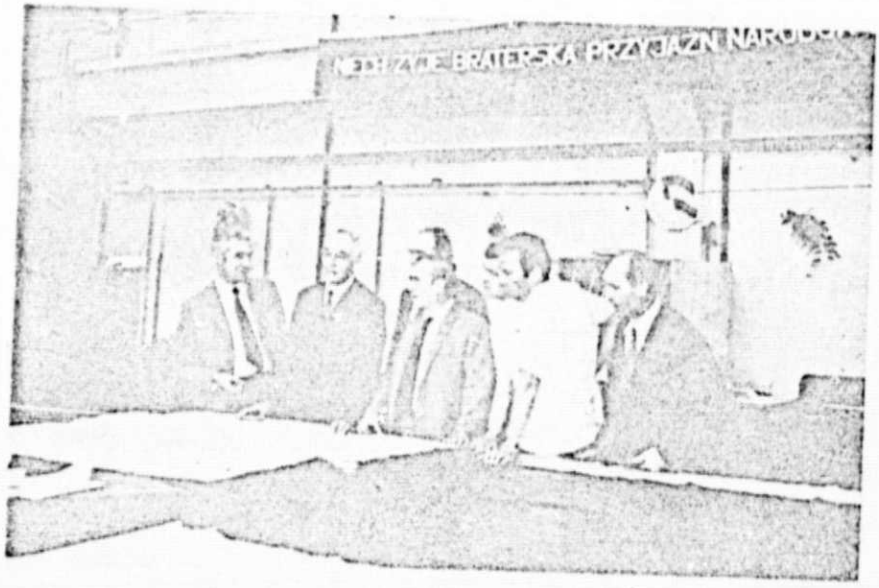
Minister of Machine Industry of the Polish Peoples Republic, T. Wrzoszczyk, and the Minister of the USSR Aircraft Industry, P. Dement'yev.

In conformity with the tradition of the Mielec factory in which it is manufactured, it received the designation M and the serial number 15. At first sight, the M-15 aircraft system appears somewhat unusual to a layman who is used to silhouettes of supersonic aircraft. However, it is not a product of chance, but the result of deep studies and analyses of various concepts taking into account the latest solutions in agricultural support aircraft. The aircraft outline developed as a result of these considerations is highly functional from the standpoint of the requirements of an agricultural support aircraft, which, as is is well known, is confined to flights at moderate and low altitudes and above the ground.

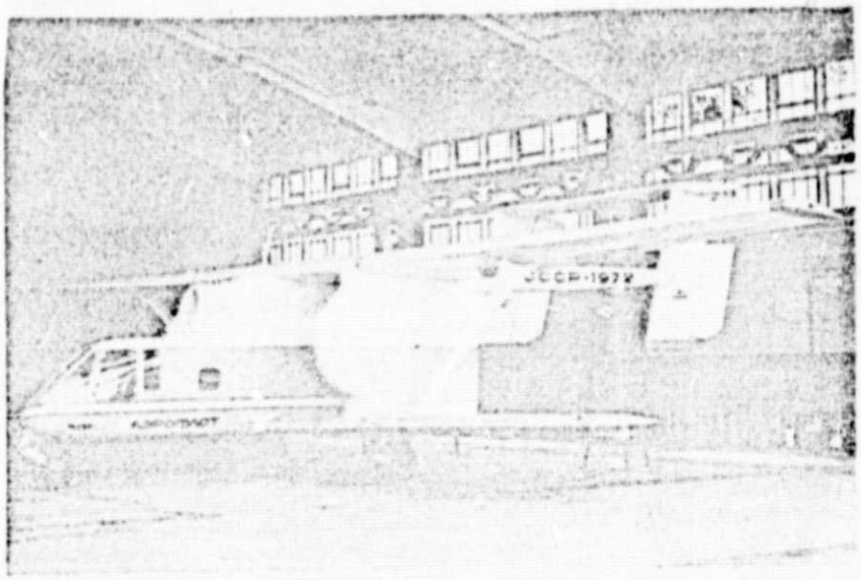
The M-15 is an all-metal twin-tail-boom sesquiplane with a short fuselage which becomes a twin tail boom in the rear part of the aircraft supporting a twin vertical tail unit on which the tail plane is mounted.

The fuselage of the aircraft with a semishell structure has in the front a convenient pilot's cockpit with perfect visibility forward and to the sides. The center section contains the following: a service compartment, intended for mounting radio equipment units and two seats used for ground personnel cross-country flights. The rear part, which is fixed on a special carriage, contains the starting unit and possibly an additional fuel tank. The nose and rear part of the fuselage are shielded by laminated screens fastened to easily disconnected locks.

The tank for chemicals, usually mounted in the fuselage, has been replaced by two formed tanks secured in special housings between the plane wings. The use of all these means, i.e. a twin-tail-boom system with a highly mounted tail unit and chemical tanks located behind the fuselage allowed a successful solution of a fundamental problem confronting all agricultural aircraft designers, namely elimination of the harmful effect of chemicals on the pilot and structure of the aircraft. Among other reasons, a great deal of attention has been given to this problem because the chemicals that are going to be used in the future in agriculture will be more effective.



Deputy Minister of USSR Aircraft Industry, A. Bielonskiy, with Polish and Soviet designers in WSK-Mielec.



Mockup of M-15 aircraft.

Using a sesquiplane system permitted rational division of functions between the upper and lower wing. Thus, the two-spar upper wing fulfills the basic task of generating aerodynamic lift. Besides laminated ailerons mounted at its ends it is equipped, for this purpose, with superlifting equipment in the form of hydraulically controlled and laminated two-slotted flaps and automatic slots located on the leading edge over the entire span. In this system, the lower wing has been designed to fulfill auxiliary functions, among which the most important ones are permitting placement of agricultural equipment elements together with pneumatic haulage pipes.

The use of a Yak-40 aircraft AI-25 bypass tubojet engine which is an abundant source of compressed air, besides eliminating the turn in the flow around it through the whirling

airscrew (which occurs when a piston or even a turboprop engine is used), allowed using the compressed air not only for air conditioning purposes, but above all, also for driving agricultural equipment, aerating chemicals in tanks and transporting them along the wing span. The resulting agricultural equipment which is highly efficient and completely modern incorporates a number of new solutions. Compared with the gasoline engines widely used in aircraft, the higher fuel consumption of the AI-25 engine is compensated by the low cost of the fuel, so that in effect, the cost of the fuel used up by the M-15 aircraft will practically not exceed similar costs for the An-2 aircraft.

The starting unit intended for starting the AI-25 engine together with the AI-9 turbine engine remains on the landing ground while the aircraft is performing agricultural services. Besides starting the AI-25 engine, it allows filling aircraft tanks with fuel and liquid chemicals which may be a very significant advantage in the absence of suitable ground equipment.

The aircraft, which has a fixed tricycle landing gear with a hydraulically controlled front wheel aided hydraulically by brakes during taxiing, can be operated from field landing strips whose length does not exceed 500 meters with conventional ground strength not exceeding 3 kg/cm^2, located at elevations up to 2000 m.

The aircraft is equipped with a wide range of flight and navigation instruments signalling to the pilot situations which are hazardous to safe flight (approaching zone of critical angles of attack, malfunction of important assemblies etc.). In addition, provisions were made for building in additional radionavigation equipment allowing long cross-country flights

without ground visibility at a special request from users. Basic equipment blocks are located in special easily detached containers or racks in the service compartment.

Basic Technical Data

Geometry Data	
Length of aircraft	12.5 m
Height	5.2 m
Span (upper wing)	22.0 m
Combined wing area	67.2 m^2
Mean aerodynamic cord	1.840 m
Ailerons	
Surface area	4.35 m^2
Displacement angles	21° (up), 23° (down)
Hovering angle	220
Flaps	
Surface area	6.5 m^2
Displacement angle (maximum)	40°
Tail plane	
Airfoil section	special
Surface area	10.0 m^2
Elevator surface area	4.0 m^2
Displacement angles	40° (up), 15° (down)
Vertical tail unit	
Airfoil section	NACA 001 0M
Surface area	10.0 m^2
Rudder surface area	4.0 m^2
Displacement angle	±25°
Landing gear	
Wheel spacing	4.2 m
Base	4.0 m

Wheel dimensions	
Front wheel	700 x 250
Main wheels	720 x 360
Weight Data	
Empty aircraft weight	2400 kg
Takeoff weight	5300 kg
Lifting capacity for chemicals	2300 kg
Wing surface load	78.6 kg/m^2
Performance	
Operating speed	140-180 km/h
Minimal speed	89 km/h
Cross-country flight speed	270 km/h
Rate of Climb (H=0)	4.9 km/sec [sic]
Maximum rate of climb	8.9 km/sec [sic]
Takeoff run	185 m
Landing run	105 m
Maximum range at altitude of 300 m	1000 km

The basic materials used to build the aircraft are aluminum alloys, alloyed steels and laminated glass. Because of its short life, the use of magnesium alloys was limited, wood and cloth were completely eliminated, and the types of used rubbers were carefully selected.

Since corrosion protection is especially important for an agricultural aircraft, comprehensive corrosion protection was used. The airframe structure was divided into isolated hermetically riveted cellules and perimeters, the contact surfaces of joints were sealed and the entire airframe was coated with epoxy enamels which are highly resistant to corrosion (besides protective electroplating of individual

structural elements). The reliability and suitability of epoxy enamels was confirmed in every respect by results obtained from operating An-2 aircraft.